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DDI #01199-86
14 April 1986

The Honorable Lloyd Bentsen
Select Committee on Intelligence
United States Senate
Washington, D.C. 20510

Dear Senator Bentsen:

In response to your letter to Bill Casey of March 11th, we have sanitized our study on the "Role of Western Equipment in Soviet Oil and Gas Development." An unclassified version of this paper is enclosed for your use. We also are providing copies to the Department of Defense, Commerce and the Senate Select Committee on Intelligence for their use.

We will soon publish a classified major research paper on this topic which should provide additional information, although it would not be available for public use.

Sincerely,

STAT

Robert M. Gates
Deputy Director for Intelligence

Enclosure:
As Stated

TO: Senator Lloyd Bentsen
Senate Select Committee on Intelligence

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SELECT COMMITTEE ON INTELLIGENCE

United States Senate

WASHINGTON, DC 20510

March 11, 1986

The Hon. William J. Casey
Director of Central Intelligence
The Central Intelligence Agency
Washington, D.C. 20505

Dear Bill:

As we consider our national policy with regard to the sale of oil field equipment to the Soviet Union, it is vital that all available information be laid on the table for public examination and consideration, except for information whose release could cause damage to our national security. In this regard, I want to address a CIA study entitled Role of Western Equipment in Soviet Oil and Gas Development (U), completed and issued by your agency in September 1984. This study is directly relevant as to the effects on the Soviet Union of the U.S. embargo of oil field equipment, and I believe it deserves a wider audience than just those of us who are presently privy to its information.

The study is classified at the SECRET level. Given the time that has elapsed since the information on which it is based was assembled, I wonder if much--if not all--of the information in this study could not now be made public. I am certainly not asking for the release or declassification of material that would have any adverse effect on our national security. I believe, though, that the level of debate on this important issue would be raised by having added to it the benefits of the CIA's work in this area. Can this study, or as much of it as possible, be released to the public at an early date?

Sincerely,

Lloyd

Lloyd Bentsen

Washington, D.C. 20505

DDI #01198-86

14 April 1986

The Honorable Dave Durenberger
Chairman
Select Committee on Intelligence
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

Several weeks ago, Senator Bentsen asked us to look into whether the information in the September 1984 study "Role of Western Equipment in Soviet Oil and Gas Development" might not be made public.

We have been able to sanitize this paper and an unclassified version is enclosed for whatever use the Committee may wish to make of it. We have provided unclassified copies to Senator Bentsen and to the Departments of Commerce and Defense.

Sincerely,

STAT

Robert M. Gates
Deputy Director for Intelligence

Enclosure:
As Stated

TO: Senator Dave Durenberger
Chairman, Senate Select Committee on Intelligence

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Central Intelligence Agency
Office of the Deputy Director for Intelligence

DDI #01200-86
14 April 1986

NOTE TO: The Honorable Richard Perle
Assistant Secretary of Defense for
International Security Policy

Richard -

At the request of one of the members of the Senate Select Committee on Intelligence, we have sanitized and forwarded an unclassified copy of a 1984 study on the "Role of Western Equipment in Soviet Oil and Gas Development." I attach an unclassified copy should you wish to make use of it in your ongoing efforts relating to technology transfer.

STAT [redacted]

Robert M. Gates
Deputy Director for Intelligence

Attachment:
As Stated

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Central Intelligence Agency

Washington, D.C. 20505

DDI #01201-86

14 April 1986

The Honorable Malcolm Baldrige
Secretary of Commerce
Washington, D.C. 20230

Dear Mac:

At the request of one of the members of the Senate Select Committee on Intelligence, we have sanitized and issued on an unclassified basis the enclosed assessment of "Soviet Needs for Western Petroleum Technology and Equipment." I forward a copy to you for whatever further use you and your colleagues at Commerce may wish to make of it.

Regards,

Bill

William J. Casey
Director of Central Intelligence

Enclosure:
As Stated

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Soviet Needs for Western Petroleum Technology and Equipment

Summary

The exploration and development of new oil and gas deposits in the USSR during the 1986-2000 period will pose increasingly complex technical challenges. Because Soviet industry will remain unable to supply the technology and high-quality equipment required for critical applications, the importance of Western equipment to the Soviet effort will increase markedly. In particular, deeper drilling in offshore and onshore exploration and development, as well as the exploitation of corrosive ("sour") oil and gas deposits, will require significant inputs of Western technology and equipment.

This memorandum analyzes the availability of Western technology and the supplementary measures adopted by the Politburo to ensure the reequipping of the Soviet oil and gas industries with improved equipment in the 1986-2000 period. Major equipment improvements are urgently needed to work oil and gas deposits under increasingly hostile operating environments onshore and offshore. Faster exploration and development of new oil reserves also is critical if Moscow is to avoid a sharper downturn in oil production, which provides 40 percent of domestic primary energy supply and 50 percent of the USSR's foreign earnings.

Soviet Energy Production

Since 1960, output of primary energy--crude oil, natural gas, coal, hydroelectric power, nuclear power, and minor fuels--has tripled. Growth has been uneven among the major fuels, however. Coal was the main fuel for the national economy before the mid-1960s but by 1985 its share of primary energy production was only 21 percent. Meanwhile, oil output soared from 3 million barrels per day (b/d) in 1960 to a peak 12.3 million b/d in 1983, before declining to 11.9 million (b/d) in 1985, an amount equal to 37 percent of primary energy production. Natural gas output has grown even more rapidly--from 45 billion cubic meters (m^3) in 1960 to 643 billion m^3, or 33 percent of primary energy, in 1985.

With expanding energy production has come an ever increasing share of industrial investment--up from 28 percent in 1975 to 35 percent in 1984. The continuing emphasis on oil production has resulted in the allocation of nearly half of energy investment to the oil industry since 1981. This emphasis has cut into the resources available for the coal and electric power industries, thereby contributing to the stagnation of coal production and the marginal inadequacy of electric power supply. The burdensome nature of oil production is illustrated by the relationship of changes in investment and output between 1975 and 1984. Oil investment rose by some 135 percent while oil output increased 25 percent. The gas industry, in contrast, presented a remarkable success story: investment rose about 75 percent while output doubled.

Soviet energy production is affected by the quantity and quality of exploitable resources, the quality and availability of equipment and technology, and the supply and utilization of skilled management and labor. Because of oil's preeminence as an export commodity and source of foreign currency, the most urgent problems center on oil production. Although Western experts have estimated Soviet oil reserves at roughly 50-70 billion barrels, Moscow's effort to sustain oil output at a high level is encountering serious difficulties and increasing costs that reflect such factors as past emphasis on production at the expense of exploration, the effects of years of excessive production rates at giant fields, increasing amount of water in output of older wells, severe operating conditions in subarctic West Siberia, and endemic problems with the supply and quality of domestic equipment.

The age and size distribution of developed reserves in West Siberia also contributes to Moscow's difficulties in maintaining oil output. The new fields tapped there since 1979 have been smaller by an order of magnitude and have lower flow rates than those brought on line in the previous decade. Moreover, the older, larger fields are already declining in production. Attempts to sustain output by drilling a large number of wells in the smaller, less productive fields lead to a steep rise in investment.

The USSR's reserves of natural gas--estimated at some 34 trillion m^3--comprise about 40 percent of the world's proven reserves and are relatively accessible, in the Soviets' view, for rapid development. However, the arctic conditions under which the clean and relatively shallow Tyumen' gas deposits must be worked are difficult, and the extraction and processing of the toxic and corrosive sour gas from the deep deposits of the Pre-Caspian Depression entail severe dangers and technical problems. Limitations also hold regarding much of the long-term substitution of other fuels for oil, especially coal.

In particular, Soviet coal production--intended to be a leading substitute for oil in the domestic economy after 2000--has been held back by the depletion of the better quality reserves in the western USSR, the low energy content and remoteness of coal supplies from Kazakhstan and East Siberia, and investment policies that for many years have favored oil.

Soviet Energy Plans and Challenges--1986-2000

The USSR's Long-Term Energy Program proposes major changes in the national energy balance. Natural gas is to provide nearly all of the increment in total primary energy production into the mid-1990s while coal, after intensive investment in production, processing, and consuming facilities, is to become the dominant fuel in the USSR after 2000. Nuclear power is to provide substantial additional energy in the 1990s and beyond.

During the 1986-2000 period, the Soviets expect the share of natural gas in the primary energy balance to expand rapidly; it could exceed 40 percent after 1990, while oil's share could shrink to about 30 percent. Natural gas has already replaced oil as the chief incremental source of energy, and we believe that the Soviets can continue to boost gas output largely by using existing domestic equipment and technology. Oil's share in the primary energy balance will decline as a result of gas-for-oil substitution and likely further slippage in oil production.

The USSR has achieved its present status as the world's leading producer of oil and natural gas largely through the application of domestically manufactured equipment. When needed, Moscow has turned to the West for selected technology and high-quality, state-of-the-art equipment to obtain higher operating performance and more reliable service, as well as to overcome shortages of key items and to supply projects for which Soviet equipment is inadequate (for example, sour-gas development). Last year, the Soviets undertook a program to enhance both the quality and quantity of equipment manufactured domestically. Thus far, however, the inefficiencies of the Soviet economic system have hindered both the production of high-quality oil and gas equipment and the assimilation of advanced techniques and equipment acquired from the West.

For some time Moscow has been sending mixed signals concerning its intentions with respect to importing Western petroleum technology and equipment. Press articles have stressed the need for better technology and high-quality equipment comparable to those obtainable from the West, but leadership statements have been ambivalent or have leaned toward a domestic solution. Soviet trade and industry officials have held talks with many

Western suppliers to elicit technical data and proposals for supply of a wide range of advanced technology and equipment, but the large imports in recent years comprised mainly pipe and equipment for gas-pipeline construction and development of sour oil and gas deposits.

Some events suggest that Soviet decisions not to follow through and order a larger amount of Western equipment reflect in part conflicting views within the Soviet bureaucracy about technical alternatives and the choice of supplier--domestic or foreign. In 1983, for example, the Soviets negotiated for the purchase of some $40 million of US high-capacity electric submersible pumps, and an export license was approved in January 1984--but the purchase was not completed. Changes in the operating condition of the wells for which these pumps had been planned may have played a part in the decision not to purchase but, on the basis of indirect and fragmentary evidence, we believe the decision not to purchase was probably influenced by other factors--ongoing bureaucratic squabbles over the relative merits of gas-lift systems and high-capacity electric submersible pumps, the allocation of hard currency, and perhaps dependency on the West.

General Secretary Gorbachev's early September 1985 speech to oil workers and party cadres in Tyumen' leaves unclear Soviet purchase intentions. His remarks neither addressed the role of Western equipment nor clearly delineated how Soviet industry can be made to achieve timely delivery of the improved equipment he recognizes as needed for the increasingly difficult production conditions (especially for oil) in West Siberia.

The tenor of Gorbachev's remarks suggests that the Soviets will seek to improve the general supply of equipment to the oil and gas fields mainly by improving the efficiency and technical level of domestic industry. To this end, some near-term gains in the supply of domestic equipment may result from Gorbachev's campaign to improve worker morale and productivity, and planning and organizational changes may ultimately lead to better planning, better product supply and quality, and prompt deliveries. However, accomplishing such a revolution within the bounds of the Soviet economic system--indeed, even laying the necessary organizational foundations--would require not only many years but also, according to some Western observers, a greater modification of the USSR's economic fabric than would in the end be acceptable to the regime.

A purely domestic solution to the equipment problem is, however, unlikely to be sufficient to offset the rapidly advancing depletion of existing oil deposits. A decision by Moscow to solve its oil production problems by a much greater reliance on Western technology and equipment would require large imports of rotary drilling rigs, oil country tubular goods, and pumping equipment.

Major Requirements for Oil and Gas Technology and Equipment

At present most of the petroleum technology and equipment used in the USSR is obtained domestically or with some help from the East European CEMA countries. The quality and technical characteristics of East European output of nearly all of the items needed for critical applications rate only low to adequate when compared to Western standards. Changing operating conditions--deeper drilling onshore and offshore, higher pressures and temperatures, corrosive producing environments, and increasing percentages of associated water production--have rendered most of those items obsolete for an increasing share of operations.

Several key oil and gas projects scheduled for 1986-90 will require Western inputs if development is to proceed on schedule. The first phase of development at Astrakhan' and Karachaganak started during 1981-85 was based heavily on equipment ordered from French and West German firms; we expect that Moscow will place additional orders with Western firms for the second phase of development during 1986-90. All the major onshore projects in the Pre-Caspian Depression--Astrakhan', Karachaganak, Tengiz, and Zhanazhol--involve development of deep, sour oil and gas deposits. Because of similar geologic conditions, the technology and main high-pressure-and-temperature, corrosion-resistant equipment packages needed for these projects will be almost identical. Only the depths, pressures, temperatures, and ratios of oil, gas, sulfur, and carbon dioxide are apt to vary. Continued exploration and development of West Siberian onshore oil and gas deposits will require generally similar equipment for deep high-pressure-and-temperature service, but without the special features for coping with high concentrations of hydrogen sulfide (H_2S) and carbon dioxide (CO_2).

The need to improve exploration efforts for deeper, harder-to-find petroleum deposits prompted the Politburo in April 1985 to authorize the reequipping of Ministry of Geology field parties with improved seismic and deep-well surveying and drilling equipment. This authorization might result in new orders for Western equipment and plants to produce some of the equipment in the USSR. The Soviets have expressed keen interest in modularized, compact deep-drilling rigs modified for air transport and arctic service, as well as in heavy-duty land rigs for deep drilling at Karachaganak, Astrakhan', Tengiz, and Zhanazhol.

Among the major Soviet offshore projects scheduled for the 1986-90 period, the most difficult will be geophysical surveying and drilling operations in the Barents Sea, Kara Sea, and offshore Sakhalin. Efficient conduct of these operations will call for Western technology, equipment, and training. Western offshore equipment that will be needed includes:

- Geophysical surveying boats capable of conducting simultaneous computerized seismic, magnetic, gravimetric, and hydrocarbon seafloor sampling surveys with online mapping capability.

- Offshore drilling rigs for platform, semi-submersible, and drillship applications--such as dynamic positioning, anchoring, and reentry systems; telescopic riser and seafloor connection systems; seafloor wellheads and blowout preventer stacks with remote hydraulic controls; mud-logging laboratories; geophysical well-logging equipment; and drilling monitoring equipment that has online capability.

- Ice-resistant structural and/or hull design may be required for the survey vessels and drillships for service in the arctic seas.

- Offshore production platforms and seafloor production systems (ice-resistant for many areas), such as templates, production manifolds, wellheads and Christmas trees, flow lines, gathering lines, and pipelines.

There is no reason to believe that the Soviets can modernize plants and produce all the new equipment that they will need in the years immediately ahead. In the USSR, the introduction of new technology, or even minor modification of an existing product, is usually a time-consuming process involving research institutes, design bureaus, ministries, and, finally, the manufacturing enterprise. Changes in production schedules, improvements in metallurgy, and introduction of new methods of metalworking for new or improved equipment production at existing Soviet and East European plants usually proceed at glacial speed. Gorbachev's moves to streamline the ministerial system and better coordinate the complex activities of research institutes, design bureaus, and production units are likely to have only slight impact on these conditions for at least several years. However, if some of the new production is assigned to the defense industries, lead times for production of many new or improved items probably could be reduced materially.

Needs for Specific Categories of Technology and Equipment

While the future course of Soviet reliance on the West to redress current production problems and face new challenges in exploration and development is yet to be determined, we expect the Soviets will continue to purchase from the West the more sophisticated and highly specialized equipment for critical operations. As exploitation and development moves increasingly to deeper onshore and offshore fields, the demand for these purchases is likely to rise. Specifically, indigenous technology and equipment will become increasingly inefficient and uneconomic relative to the more demanding technical requirements of the late 1980s--particularly in deep drilling and producing. Moreover, skilled manpower and technical services to cope with those requirements will remain in short supply. Unless Moscow turns to the West for more equipment and technical services, the decline in oil production may accelerate.

Soviet needs for high-quality technology and equipment currently available only from non-Communist suppliers are identified in table 1 by specific projects and major development regions. Table 2 summarizes the availability of oil and gas equipment by major areas of origin--CEMA, developed West (COCOM), and Third World. Indigenous Soviet and East European capabilities are generally low with respect to most of the technology and equipment needed. The following paragraphs summarize, by category of need, those indigenous capabilities and Western availability.

Oil and Gas Exploration. Soviet exploration technology and equipment are rated low by Western standards. Although technically competent, Soviet petroleum geologists use poor equipment, which limits accuracy and hinders their progress. Hungary and Romania produce some equipment that has slightly better capabilities, but they have only limited capacity for production. Moreover, the Soviet Union lags behind the West in state-of-the-art computer technology--an essential component of any advanced exploration system. Rapid improvement in the Soviet' capabilities to supply needed exploration equipment is unlikely.

State-of-the-art exploration technology is available in the United States, France, and the United Kingdom; the remaining developed Western countries have high-level technology. Austria and several Latin American countries have adequate technology. The United States has state-of-the-art capability for producing most types of exploration equipment, and Canada, France, and the United Kingdom have high capability. Other countries have production capabilities and capacities that are adequate or less than adequate for most of the surveys now being conducted, but they probably would not be adequate for much of the work that needs to be accomplished in new areas. Latin American and non-developed Asian suppliers lack a demonstrated ability to produce advanced exploration equipment.

Oil and Gas Drilling and Production. Soviet drilling and production technology, and the capability to produce equipment, is low. Romania and Hungary have slightly better capabilities, but neither can produce in sufficient volume to meet Soviet needs. None of the CEMA countries has more than a low capability for offshore operations or for deep sour oil and gas development under operating conditions that require resistance to high pressures and high temperatures. By the mid-1990s, the Soviets may be able to improve their capability somewhat, but they are unlikely in the near term to attain substantial improvements in either the design or supply of equipment. The lack of special alloys, indifferent quality control, and unresponsiveness of equipment producers to the changing technical needs of operators are likely to continue.

State-of-the-art drilling and production technology is available in the United States; most other developed countries--as well as Austria, Brazil, Mexico, Venezuela, and Singapore--can provide high-level technology. Norway has recently advanced its offshore drilling capability through the development of dynamic positioning systems and remote-control systems for operation of subsea blowout preventer stacks and other wellhead equipment. Mexico has acquired considerable experience in the production of deep sour oil, gas, and condensate onshore and offshore. Brazil is a leader in the emerging technology for seafloor completion of oil and gas wells and related seafloor production systems. Argentina, India, Peru, and Taiwan can provide adequate technology.

The United States can produce in large volume the state-of-the-art high pressure-temperature, corrosion-resistant drilling and producing equipment required for severe service (high pressure and temperature, corrosive environment). Several other developed countries have high capability to produce some items in limited quantities. Elsewhere in the West, the capability and capacity to produce these items is quite low.

Pipeline-Construction Technology, Materials, and Equipment. Soviet Arctic pipeline construction technology is adequate for most current oil and gas needs and superior to that available in Eastern Europe. Soviet materials and equipment are adequate to meet the requirements for most oil pipelines. The Soviets have not demonstrated a capability to produce significant quantities of large-diameter pipe suitable for high-pressure gas pipeline service, however. Eastern Europe has almost no capability to produce pipe over 820 mm in diameter.

Moscow, acutely aware of the problem of low-quality domestic linepipe, is attempting to upgrade existing pipe-mill capacity. Limited production capability has been achieved using a spiral-weld, multilayer manufacturing process and an alternative dual longitudinal welding process, which joins two "U" shaped sheets of steel plate to form the pipe. Although these processes are cumbersome and archaic by Western industry standards, they do provide a usable product. The unproven multiwall Soviet pipe will not, however, be easy to work with; it is heavier, shorter in length, and it will require 3 or 4 times as much welding in the field as conventional Western linepipe. Linepipe imported from the West accounts for nearly all of the 23,000 kilometers of 1,420-mm-diameter gas pipeline laid in the USSR during 1981-85. Japan, West Germany, and Italy were the principal suppliers.

The USSR is apt to depend even less on the West for gas turbines during 1986-90, largely because of increased domestic turbine production, a leveling off in the pace of Soviet construction of large-diameter gas pipelines, and availability of other power sources. The Soviets initiated a crash program during 1982 and 1983 to produce 16-megawatt (MW) and 25-MW industrial turbines. From the reported progress of the gas pipeline system, it appears that Soviet production of large industrial gas turbines has increased sufficiently to meet nearly all needs of the 1986-90 pipeline construction program. The Soviet media report success in the program to build 16-MW aeroderivative turbines from gas generators of retired engines from TU-154 aircraft. They also indicate that a number of domestically manufactured 25-MW turbines have been installed in pipeline compressor stations. West of the Urals, moreover, several compressor stations are being equipped with Soviet 12.5-MW electric motors.

The USSR also has relied heavily on the West for pipelayers, and Ministry of Gas officials have indicated the USSR will probably continue large imports of pipelayers, bulldozers, and tractors for gas pipeline construction during 1986-90. Although the Soviets reportedly have had some success in producing a prototype capable of handling 1,420-mm-diameter pipe, the pipelayer may not be suitable for use under arctic conditions nor is it being mass produced. Poor metallurgy and excessive tolerances of critical engine parts, together with a shortage of proper low-temperature lubricants, result in rapid engine wear and unreliable operation in extremely cold conditions. Short engine life and high maintenance requirements considerably exacerbate the problems of pipeline construction and operation in the arctic. To enhance pipeline system efficiency, the USSR has also purchased several pipeline control systems, as well as large quantities of pipeline valves and pipeline coating and wrapping materials.

In terms of Western availabilities, state-of-the-art pipeline technology is available from the United States and Canada; high-level technology is available from other developed Western countries. Adequate technology is widely available outside developed from Austria, Argentina, Brazil, Mexico, Venezuela, India, and Singapore. State-of-the-art and high-level pipeline equipment and linepipe are generally available from the larger industrialized countries, and Sweden and Switzerland produce gas turbines for pipeline and industrial service.

Specialized state-of-the-art pipeline materials and equipment for arctic and offshore installation are available from the United States and, for most items, from Canada. Although several Latin American oil-producing countries, India, and Singapore have some technical capability, they produce little if any of the materials and equipment. West Germany, Italy, Japan, and France have exported most of the large-diameter linepipe (Sweden also has sold some), turbine-compressors, valves, and pipeline control systems purchased by the USSR. Finally, both the United States and Japan have supplied pipelayers, but Japan has filled nearly all orders since 1979.

Oil-Refining and Gas-Processing Technology and Equipment. The USSR generally has been self-sufficient in most of the primary and secondary processing equipment installed in its oil refineries. Soviet industry, however, has had serious difficulty in producing hydrocracking equipment (for the processing of heavy feedstocks into lighter hydrocarbon fuels) and hydrogen-fluoride alkylation equipment (for the production of high-octane gasoline). Access to Western hydrocracking technology would allow the USSR to process larger amounts of heavy fuel oil into more valuable light products such as gasoline, kerosene, and diesel fuel.

On average, Soviet technology and equipment for gas processing are rated low in relation to future needs. The USSR has constructed plants that can process relatively clean gas--specifically, that from the northern Tyumen' deposits, but even there the Soviets have had to use imported equipment for refrigeration and other special needs. They have not had similar success with domestic technology in developing the sour gas deposits of Orenburg, the Pre-Caspian Depression, and Central Asia. Their attempts in the late 1960s to develop the Central Asian sour gas fields with domestic equipment experienced major setbacks from accidents involving H_2S. In 1976 the Soviets finally turned to the West for sulfur-removal technology and for equipment that would enable them to produce and process sour gas on a commercial basis at the Orenburg gas complex.

In the West, state-of-the-art oil refining technology is available from all of the larger developed countries; high-level technology is available from Austria and Singapore, and an adequate level is offered by some Latin American and Asian countries. The larger Western countries also offer state-of-the-art refinery equipment, although not all countries produce all types of equipment. Firms in Japan, France, West Germany, the United Kingdom, and Canada, for example, can provide the technology and equipment for the hydrocracking process and Canada and Western Europe have some capability to manufacture equipment and to install the hydrogen fluoride-alkylation process. Singapore has high overall capability for production of refinery equipment, but the capability of most of the other Asian and Latin American sources is low, except for Mexico and Venezuela, which have high capability to produce fluid catalytic crackers.

The United States has state-of-the-art gas-processing plants. West Germany, France, the Netherlands, and Italy can supply comparable high-level equipment; Mexico and Venezuela, adequate equipment. The Soviets have purchased technology and equipment for the major sour oil and gas development projects in the Pre-Caspian Depression mainly from French and West German firms.

Synthetic Fuel From Coal. Soviet long-range planning for the coal industry is based on a major expansion of open-pit operations. Much of the coal to be mined is poor in heat content, and some cannot be shipped for long distances because its high moisture content results in spontaneous combustion. Consequently, new solutions are needed to facilitate the long-distance transportation of energy from coal, including possibly the development of a synfuels industry. The Soviets hope to be largely self-sufficient in surface-mining equipment; but, until the heavy equipment plant at Krasnoyarsk goes into full production in the late 1980s, Moscow will continue to purchase from East Germany and from Western suppliers.

In recognition of the difficulty of supplying increasing amounts of liquid fuels at a time when oil production is faltering, the Soviet Long-Term Energy Program included reference to development of synfuels production from coal. Moscow has targeted "commercial-scale" production for the mid-1990s; we believe that this goal means several million tons of liquid fuel from coal annually.

Soviet synfuels research program has focused on development of two technologies that yield synthetic liquid fuels: pyrolysis and direct coal-conversion. The Soviets probably will not need substantial Western technical assistance to construct commercial-scale pyrolysis facilities; a demonstration plant was completed in 1983. However, the Soviet effort to improve the Bergius direct-conversion process--a technology obtained from Germany at the end of World War II--has met with only limited success. An official of a West Siberian scientific institute reported in 1983 that Soviet experimental work on direct conversion was insufficient to support a major synfuels project. If the USSR decides to build a commercial-scale direct-conversion facility during the 1990s, we believe that substantial Western technology and equipment would be required.

Most of the proven direct-conversion technology for pilot-plants with operating capacities greater than 5 tons a day (coal) originated in the United States. The West German firms Ruhrkohle and Veba operate in West Germany the only significant direct-conversion plants located outside the United States. Ruhrkohle also has a financial interest in the so-called EDS and H-Coal processes developed in the United States and has rights to the technology. The USSR is unlikely to purchase equipment for a synfuels industry in the near term because it does not plan to build commercial-scale liquefaction facilities until after 1990.

Table 1
Soviet Needs for Western Oil and Gas Equipment and Technology for Key Projects, 1985-2000

	Offshore			Onshore				
	Barents Sea	Sakhalin	Caspian Sea	Astrakhan' Gas/ Condensate	Tengiz Oil/Gas	Karachaganak Gas/ Condensate	Zhanazhol Oil/Gas	N. Tyumen' Oil/Gas
Exploration								
Technology (all phases)	•	•	•					
Project feasibility and management studies	•	•	•	•	•	•	•	
Technical integration of hardware and software	•	•	•	•	•	•	•	•
Geophysical equipment (all types)	•	•	•					
Seismic survey vessels (equipment package-excluding hull and boat)	•	•	•					
Satellite navigation equipment	•	•	•					
Acoustic/ultrasonic sensors and geophysical equipment:								
Geophones for onshore and offshore seismic surveying	•	•	•	•	•	•	•	•
Land gravimeters	•	•	•	•	•	•	•	
Magneto-telluric systems								
Well-logging equipment	•	•	•	•	•	•	•	•
Mud-logging equipment	•	•	•	•	•	•	•	•
Monitoring equipment for drilling operations (mud systems and drill-stem testing equipment)	•	•	•	•	•	•	•	•
Computer hardware	•	•	•	•	•	•	•	•
Drilling and Production								
Technology (all phases)	•	•	•					
Project feasibility and management studies	•	•	•	•	•	•	•	•
Technical integration of hardware and software	•	•	•	•	•	•	•	•
Equipment (all types)	•	•	•					
Corrosion-resistant producing equipment (all types) [a]	•	•	•	•	•	•	•	•
Christmas trees and blowout preventers	•	•	•	•	•	•	•	•
Remote control systems	•	•	•	•	•	•	•	•
Wellheads	•	•	•	•	•	•	•	•

Footnotes appear at end of the table.

Table 1
Soviet Needs for Western Oil and Gas Equipment and Technology for Key Projects, 1985-2000 (continued)

	Offshore			Onshore				
	Barents Sea	Sakhalin	Caspian Sea	Astrakhan' Gas/Condensate	Tengiz Oil/Gas	Karachaganak Gas/Condensate	Zhanazhol Oil/Gas	N. Tyumen' Oil/Gas
Special steel tubes—casing, tubing, drill collars, drill pipe	•	•	•	•	•	•	•	•
Packers, seals, valves	•	•	•	•	•	•	•	•
Pump rods	•	•	•		•		•	•
Deep submersible pumps (below 600-meter depths)	•	•	•		•		•	•
Manifold systems	•	•	•	•	•	•	•	•
Chemical inhibitors	•	•	•	•	•	•	•	•
High-pressure/temperature production equipment (all types)				•	•	•	•	•
Christmas trees and blowout preventers	•		•	•	•	•	•	•
Remote control systems	•	•	•	•	•	•	•	•
Wellheads	•	•	•	•	•	•	•	
Casing and tubing	•	•	•	•	•	•	•	•
Packers, seals, valves	•	•	•	•	•	•	•	•
Deep submersible pumps (below 600-meter depths)	•	•	•		•		•	•
Deep-well drilling rigs and tools (below 3,000-meter depths onshore and offshore)	•	•	•	•	•	•	•	•
Offshore drilling platforms	•	•	•					
Measuring instruments and control systems	•	•	•	•	•	•	•	•
Riser and motion compensation systems	•	•	•					
Dynamic positioning systems	•	•	•					
Pipeline Construction								
Technology (all phases)								
Project feasibility and management studies	•	•	•					
Technical integration of hardware and software	•	•	•					
Materials and equipment (all types)								
Large-diameter pipe (1,020- to 1,420-mm-diameter pipe)	•			•		•		•

Footnotes appear at end of the table.

Table 1
Soviet Needs for Western Oil and Gas Equipment and Technology for Key Projects, 1985-2000 (continued)

	Offshore			Onshore				
	Barents Sea	Sakhalin	Caspian Sea	Astrakhan' Gas/ Condensate	Tengiz Oil/Gas	Karachaganak Gas/ Condensate	Zhanazhol Oil/Gas	N. Tyumen' Oil/Gas
Pipe wrapping and coating materials	•	•	•	•	•	•	•	•
Large-diameter valves (1,020- to 1,420-mm-bore)	•	•	•	•		•		•
Pipeline control systems	•	•	•	•	•	•	•	•
Turbine drivers and compressors (aeroderivative; turbines)	•	•	•					
Heavy duty pipelayers (over 50-ton load capacity)				•	•	•	•	•
Gas Processing and Oil Refining								
Technology (all phases)								
Project feasibility and management studies	•	•	•	•	•	•	•	•
Technical integration of hardware and software	•	•	•	•	•	•	•	•
Equipment								
Fluid catalytic cracking (FCC)								
Hydrocracking								
Reduced crude cracking (alternative to FCC)								
Hydroprocessing								
Delayed coking and fluid coking								
Catalytic reforming								
Hydrogen fluoride alkylation								
Equipment for production of additives for lubes								
Gas processing plants	•	•	•	•	•	•	•	•

[a] Corrosion-resistant equipment is essential for operations in the sour oil and gas deposits of the Pre-Caspian Depression; elsewhere, it would greatly reduce the need for frequent replacement of downhole tubing and wellhead equipment.

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Table 2
Quality and Availability of Oil and Gas Equipment, by Major Area of Origin [a]

	CEMA		USA	COCOM	Non-COCOM Western Europe	Third World
	USSR	Eastern Europe				
Exploration						
Technology (all phases)	Lo	Lo	X	Hi-X	O-A	O-A
Project feasibility and management studies	Lo	Lo	X	Hi-X	O-A	O-A
Technical integration of hardware and software	Lo	Lo	X	Hi-X	O-Lo	Lo-A
Geophysical equipment (all types)	Lo	Lo	X	A-Hi	Lo	O-Lo
Seismic survey vessels (equipment package excluding hull and boat)	Lo	Lo	X	A-Hi	Lo	O-Lo
Satellite navigation equipment	Lo	Lo	X	Hi	Lo-Hi	O-Lo
Acoustic/ultrasonic sensors and geophysical equipment:						
Geophones for onshore and offshore seismic surveying	Lo	Lo	X	O-Hi	O	O-Lo
Land gravimeters	Lo	Lo	X	O-Hi	O-Hi	
Magneto-telluric systems	Hi	A				
Well-logging equipment	Lo	Lo	X	O-Hi	O	O-Lo
Mud-logging equipment	Lo	Lo	X	O-Hi	O	O-Lo
Monitoring equipment for drilling operations (mud systems and drill-stem testing equipment)	Lo	Lo	X	O-Hi	O	O-Lo
Computer hardware	Lo	Lo	X	A-Hi	O	O-Lo
Drilling and Production						
Technology (all phases)	Lo	Lo	X	Hi	O-Hi	A-Hi
Project feasibility and management studies	Lo	Lo	X	Hi	O-Hi	A-Hi
Technical integration of hardware and software	Lo	Lo	X	Hi	O-Hi	A-Hi
Equipment (all types)	Lo-A	Lo-A	X	Lo-Hi	O-A	O-A
Corrosion-resistant producing equipment (all types)	Lo	Lo	X	Lo-Hi	Lo-A	O-Lo
Christmas trees and blowout preventers	Lo	Lo	X	A-X	O-A	O-Lo
Remote control systems	O	Lo	X	O-X	O-A	O-Lo
Wellheads	Lo	Lo	X	A-Hi	O-Hi	O-Lo
Special steel tubes-casing, tubing, drill collars, drill pipe	Lo	Lo	X	O-Hi	O-Hi	O-Hi

Footnotes appear at end of the table.

Table 2
Availability and Capability of Oil and Gas Technology and Equipment, by Regions of Origin [a] (continued)

	CEMA		USA	COCOM	Non-COCOM Western Europe	Third World
	USSR	Eastern Europe				
Packers, seals, valves	Lo	Lo	X	O-Hi	O-Lo	O-A
Pump rods	Lo	Lo	X	O-Hi	O-Hi	O-A
Deep submersible pumps (below 600-meter depths)	Lo	Lo	X	O-A	O	O
Manifold systems	Lo	Lo	X	Hi-X	Lo-Hi	O-Hi
Chemical inhibitors	Lo	Lo	X	Hi-X	O-Hi	O-A
High-pressure/temperature production equipment (all types)	Lo	Lo	X	Lo-Hi	O-Lo	O-Lo
Christmas trees and blowout preventers	Lo	A	X	Lo-X	O-A	O-Lo
Remote control systems	O	Lo	X	A-X	O-A	O-Lo
Wellheads	A	A	X	Lo-Hi	O-A	O-Hi
Casing and tubing	Lo	Lo	X	Lo-X	O-Hi	O-Hi
Packers, seals, valves	Lo	Lo	X	O-A	O-Lo	O-A
Deep submersible pumps (below 600-meter depths)	Lo	Lo	X	O-A	O	O
Deep-well drilling rigs and tools (below 3,000-meter depths onshore and offshore)	Lo	Lo	X	Hi	O-Hi	O-Hi
Offshore drilling platforms	Lo	Lo	X	Hi	O-A	O-Hi
Measuring instruments and control systems	Lo	Lo	X	Lo-Hi	O-A	O
Riser and motion compensation systems	Lo	Lo	X	Hi	O	O
Dynamic positioning systems	Lo	Lo	X	A-Hi	O	O
Pipeline Construction						
Technology (all phases)	A	A	X	Hi-X	O-A	O-A
Project feasibility and management studies	A	Lo	X	Hi-X	O-A	O-A
Technical integration of hardware and software	A	Lo	X	Hi-X	O-A	O-Lo
Materials and Equipment (all types)	Lo	Lo	X	Hi-X	O-Lo	O-Lo
Large-diameter pipe (1,020- to 1,420-mm-diameter pipe)	Lo	Lo	Hi	Hi-X	O-Hi	O
Pipe wrapping and coating materials	Lo	Lo	X	A-X	O-Lo	O
Large-diameter valves (1,020- to 1,420-mm bore)	Lo-A	Lo	X	A-X	O	O
Pipeline control systems	Lo	Lo	X	Hi-X	O	O
Turbine drivers and compressors	A	Lo	X	Hi-X	O-Hi	O
Heavy duty pipelayers (over 50-ton load capacity)	A	Lo	X	O-X	O	O

Footnotes appear at end of the table.

Table 2
Availability and Capability of Oil and Gas Technology and Equipment, by Regions of Origin [a] (continued)

	CEMA		USA	COCOM	Non-COCOM Western Europe	Third World
Processing and Refining	USSR	Eastern Europe				
Technology (all phases)	Lo	A	X	X	A-Hi	Lo-Hi
Project feasibility and management studies	Lo	A	X	X	A-Hi	Lo-Hi
Equipment (all phases)	Lo-A	Lo	X	X	Lo-A	Lo-Hi
Fluid catalytic cracking (FCC)	Lo-A	Lo	X	X	Lo-A	Lo-Hi
Hydrocracking	Lo	O	X	Lo-Hi	Lo-A	Lo-Hi
Reduced Crude Cracking (alternative to FCC)	O-Lo	O	X	O-X	O	O-Lo
Hydroprocessing	A	Lo	X	X	Lo	Lo-A
Delayed coking and fluid coking	Lo-A	Lo	X	Hi	Lo	O-A
Catalytic reforming	Hi	A	X	X	A	Lo-A
Hydrogen-fluoride alkylation	Lo	O	X	O-A	O	O
Equipment for production of additives for lubes	Lo	Lo	X	Hi-X	A	O-Lo
Gas-processing plants	Lo	Lo	X	Hi	O	O-A

[a] Analysis of data from *Composite Catalog of Oil Field Equipment and Services 1984-85*, Gulf Publishing Company.

Key:
X = Highest or state-of-the-art capability.
Hi = More than adequate for needs.
A = Adequate for most needs.
Lo = Some capability, but inadequate for most needs.
O = No demonstrated capability.
Blank = Unknown.
Listing of more than one code in an entry (for example, Lo-Hi) indicates that some country or countries in the group have the higher capability, while the rest have at least the indicated lower capability.